Cardiovascular Stability with Dexmedetomidine
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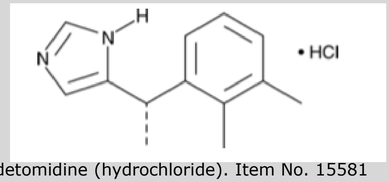
Introduction

Cardiac surgery can have many post-operative complications due to specific risks of the procedure along with anesthetic risks. These complications can prolong hospital stay and affect the mortality rate (Wang, 2018). Coronary artery bypass surgery (CABG), for example, includes a painful incision that may cause significant post-operative pain. The stimulus of tracheal intubation can trigger sympathetic response and affect the maintenance of homeostasis. Post-operative care includes pain control along with a level of sedation. The Intensive Care Unit (ICU) is the phase of care as they leave the operating room until they transition to a telemetry bed. Up to 25% of mortality can be traced directly to ICU care of the patient (Shannon, 2012).
Dexmedetomidine (Precedex) is a highly selective alpha 2 adrenoceptor agonist with both analgesic and sedative properties. It is commonly used for procedural sedation, ICU sedation, and peri-operative pain control. Physiologic effects include reduced cerebral blood flow (CBF), cerebral metabolic rate of oxygen (CMRO2), and intracranial pressure (ICP). It works on receptors in the central nervous system, effector organs, such as vascular smooth muscle, and tissues innervated by the sympathetic nervous system. In comparison to induction agents, such as propofol and ketamine, Precedex makes an excellent anesthetic because of the additional analgesic effects. It causes patients to enter the normal sleep stage through an endogenous sleep-promoting pathway and reduces the incidence of delirium (Mantz, 2011).
Hemodynamic side effects include hypotension and bradycardia due to the activation of alpha 2 receptors leading to arterial muscle relaxation. Precedex should be administered by continuous infusion; however, a bolus dose can also be given. Infusion and sedation dose ranges between 0.2 and 1 mcg/kg/hr and the continuous infusion cannot exceed 24 hours (Hoy, 2011). Precedex has been shown to maintain respiratory stability by unchanged respiratory rates, oxygen saturation, and arterial PCO2. Post-operative atrial fibrillation is a common complication that occurs in about 50% of all heart surgeries, although temporary, it can cause hemodynamic instability (Echahidi, 2008). Preventing atrial fibrillation can decrease the risk of death in patients after heart surgery. Delirium is also particularly frequent in critically ill patients, highest occurrence in those receiving mechanical ventilation and those who are older. Delirium is associated with numerous long-term effects such as cognitive impairment and psychological problems (Kazmierski, 2010). It's very important to consider using Precedex to reduce the length of ICU stay and hospitalization. The use of opioids and NSAIDs for postoperative pain management is less effective and less advantageous than Precedex because of analgesia and sedation that occurs with Precedex. The purpose of this study is to examine the advantage of using dexmedetomidine perioperatively for cardiovascular surgeries, and whether its benefits outweigh the side effects. Do patients undergoing cardiac surgery have better outcomes with dexmedetomidine?

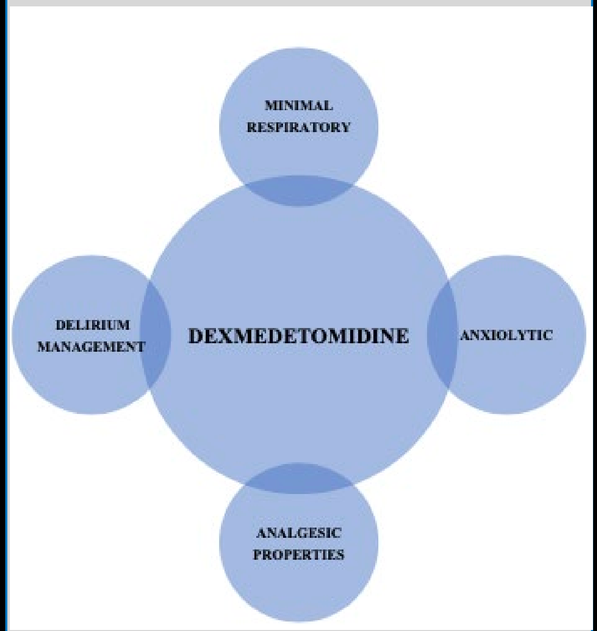
Methods and Materials

The inclusion criteria for the study consisted of adults who were involved in surgical ICU admission. The participants were 50 patients undergoing open- heart surgery, which requires intubation and mechanical ventilation in the ICU postoperatively. The mechanical ventilation timing requirement was at least 24 hours. Half of the patients received a dexmedetomidine infusion and a sedation dose range of 0.2-0.1 mcg/kg/hr, whereas the rest served as the placebo group. The study took place at HCA Florida University Hospital. The placebo group received standard sedation but without the use of precedex. Written informed consent was obtained by participants, or participants' families, which disclosed information about the research process. Most of the patients had a similar comorbidity index. Exclusion criteria was severe cognitive impairment, pregnant or breast-feeding, allergy to dexmedetomidine, and persistent bradycardia. Furthermore, other exclusion criteria included sepsis, severe heart failure, or acute myocardial infarction during ICU stay.
The ICU Medical Plum 360 was used for the dexmedetomidine infusion with the designed PlumSet cassette, which allowed automated back-priming. Infusion consisted of a 100 mL premix bag with a total amount of 200 mcg/50 ml and a concentration of 4 mcg/ml of precedex. The ICU used a triple IV stand with a patient support wheel for the medical plums.
Double-blind, randomized control trial was conducted at the Florida University Hospital. Richmond Agitation Sedation Scale (RAAS) score was used for both groups to determine sedation depth. RAAS score of zero means a calm state, whereas a score of -2 refers to lightly sedated. A light level of sedation allows the patients to be assessed to see if they are in pain or experiencing delirium. The 25 patients receiving precedex infusion were assigned to Group 1 as the control group. The control group received sedation with dexmedetomidine and analgesia continuously. The infusion was continued for at least 10 days, or until extubating. The remaining participants were classified as the placebo group labeled Group 2, who didn't receive dexmedetomidine infusion. Group 2 received sedative drugs, such as midazolam, propofol, and analgesia. Sedation was kept throughout mechanical ventilation. The effectiveness of the sedation infusion was examined by the duration of ICU stay and discharge time, as well as the number of days alive without delirium.



Dexmedetomidine (hydrochloride). Item No. 15581
https://www.caymanchem.com/product/15581/dexmedetomidine-(hydrochloride)

Charts/Graphs/Pictures



Results and Discussion

Patients in Group 1 spent less time on the ventilator and developed less delirium. Bradycardia and hypotension were found to be the only unfavorable effects. Overall, the patients benefited from using dexmedetomidine in practically ill patients, especially because of the shorter duration of unresponsive sedation. The study also found that these patients spent more time at the targeted level of sedation than those in Group 2. The control group had reduced time to extubating and increased ventilator-free hours. While receiving the drug, the median RASS score was around -2 with dexmedetomidine, a slightly lower score for those receiving midazolam and propofol. One limitation of the study was opioids because they could have affected the outcome. Another limitation is that due to the small sample size a more extensive study needs to be done to confirm results. The mechanically ventilated adults with post-open-heart surgery treated with precedex showed improved outcome than those who did not receive precedex.

References

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